Name _____

NASA/Tropical Rainfall Measuring Mission (TRMM)
Topic #4: Lightning
Activity #2: Instant Ice

OBJECTIVE: To model the formation of hail from super-cooled raindrops

BACKGROUND: In thunderstorms, rising air currents called *updrafts* carry cloud droplets high in the cloud where the temperature is below the freezing point of water (32°F or 0°C). Super-cooled raindrops do not freeze until they come in contact with a pattern such as a particle of ice on which the water can *assemble* its frozen crystals. This fact is critical to the success of your investigation. If your test tube contains any dust particles on which ice particles can cling, the water will freeze as the temperature reaches the freezing point instead of freezing when you introduce a piece of ice. Therefore, ***do NOT put anything in the test tube except fresh water and ice!*** In thunderstorms *soft* hail pellets called graupel (pronounced GROU-pel), grow in size as super-cooled water adds layers of frozen glaze. Hail develops when updrafts prevent the graupel from falling and new layers of ice continue the growth process. In rare cases updrafts of 90 mph can support hailstones weighing more than a pound. A 100 mph updraft is required for the development of three inch hailstones (8cm/baseball size) which occasionally fall in the Great Plains of the central USA. When the updrafts can no longer support the weight of the hailstone, it falls. It is the collision of the ice particles in these storms that is believed to be responsible for the development of strong electrical charges that lead to lightning. The instruments aboard the TRMM satellite enable scientists to study the water, graupel and hail in thunderstorms.

MATERIALS: (per group) water, ice, thermometer, stirring rod or spoon, salt, clock, 500 mL beaker or jar, one large *very clean* or new test tube

PROCEDURE:
1. Fill the beaker _ full of ice. Add water to the level of the ice.
2. Add enough salt that after stirring it will no longer dissolve.
3. Place the thermometer in this saltwater bath.
4. Rinse the test tube to ***remove all dust and dirt.***
5. Fill the test tube with cold water. Place it in the saltwater bath. Adjust the level of the water in the test tube so that it is the same level as the saltwater bath. A lower level will not affect the results, but the water should never be higher than the bath.
6. Allow the test tube to sit in the saltwater bath for ten minutes. ***Gently*** stir the saltwater bath ***with the stirring rod***. Avoid breaking the thermometer. Watch the temperature carefully. As melting occurs, add more salt and ice to lower the temperature as far as possible**.** If your water freezes as the temperature drops, your test tube was dirty. Stop. Rinse your test tube and begin again. **NOTE**: It willrequire ten minutes for the temperature of the water in the test tube to reach the same temperature of the saltwater bath. Do ***not*** place the thermometer in the test tube as it will introduce salt particles!

7. As ten minutes nears its end, prepare a small piece of ***non salty*** ice.
8. After ten minutes, record the temperature in the data table.
9. Remove the test tube. While holding it where ***all group members*** can make an observation, ***immediately*** add the piece of ***salt free*** ice.
10. Record your observations.
11. Rinse your test tube and repeat steps 4 to 10.

DATA:

Trial	Temperature °C	Observations
#1		
#2		

SUMMARY QUESTIONS:

1. What is the freezing point of water in °C? _____
2. What was the temperature of the saltwater bath at the end of ten minutes? _____
3. If the temperature in the test tube was below the freezing point, why do you think the water freeze did not freeze? (Assume that the water in the test tube is the same temperature as the saltwater bath.) _____
4. What happened when the piece of ice was added to the test tube? _____
5. Why was it important to use a clean test tube? _____
6. How do storms support heavy hailstones?_____
7. What is believed to be responsible for the development of electrical charges and lightning? _____